

Drilling to Search for Subsurface Life on Mars: Analog Drilling Experiment in Rio Tinto, Spain
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MARTE (Mars Analog Rio Tinto Experiment) developed an automated drilling system on a simulated Mars lander platform including drilling, sample handling, core analysis and down-hole instruments relevant to searching for life in the Martian subsurface. This was demonstrated in the simulation of a Mars drilling mission that includes interpretation of drill mission results by a remote science team in a blind test. The test took place in September 2005 at Rio Tinto, Spain, a geochemical analog to sulfate rich deposits such as Sinus Meridiani on Mars. A remote science team analyzed data from the drilling platform to search for evidence of subsurface life. The science approach of the simulated drilling mission drew heavily on lessons learned from a successful search for subsurface life at the field site using conventional laboratory techniques. The drilling system, developed by Honeybee robotics for future use on Mars, brings to the surface core segments 25 cm long x 2.5 cm diameter. The drill operates on low power without the use of drilling fluids and can achieve a total depth of 10 m. An automated core handing stage receives cores from the drill and passes them under a suite of instruments including macroscopic and microscopic core imaging, hyperspectral imaging, and ATP luminometry. When the drill is withdrawn, a borehole inspection system acquires borehole panoramas and Raman spectra boresighted with microscopic images. Based on analyses of these observations, a science team selects locations for core subsampling whereupon a slice is cut from the core, crushed, and resulting powdered samples are placed into automated life detection instruments.

The MARTE mission simulation is the first time a field test of a robotic drilling system including science payload and remote science analysis has been performed. Results from the remote science teams' interpretations will be compared with ground truth from the field.